WORK PLAN
OPERABLE UNIT 2 GROUNDWATER REMEDY
SYSTEM EXPANSION PHASE II
FORMER FORT ORD, CALIFORNIA

TOTAL ENVIRONMENTAL RESTORATION CONTRACT II
DACW05-96-D-0011

Submitted to:

Department of the Army
Corps of Engineers
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Submitted by:

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Revision 0

March 2006

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List of Acronyms

AHA	Activity Hazard Analysis
Army	U.S. Department of the Army
ASTM	American Society for Testing and Materials
bgs	below ground surface
CCR	Construction Completion Report
CIH	Certified Industrial Hygienist
CQC	contractor quality control
CQCSM	Contractor Quality Control System Manager
CUL	Conventional Utility locator
EW	extraction well
FWV	field work variance
gpm	gallons per minute
GPR	ground penetrating radar system
GPS	global positioning system
GWTP	groundwater treatment plant
HDPE	high-density polyethylene
HMP	Installation-Wide Multispecies Habitat Management Plan
HS	health and safety
LPGAC	liquid phase granular activated carbon
OU2	Operable Unit 2
OU2 ROD	Record of Decision, Operable Unit 2
PCQCP	Program Contractor Quality Control Plan for Sacramento Total Environmental Restoration Contract
PG&E	Pacific Gas and Electric
PLC	programmable logic controller
psi	pounds per square inch
QA	quality assurance
QC	quality control
RAO	remedial action objective
RTK	Real-Time Kinematic
SCADA	supervisory control and data acquisition
SSHO	site safety and health officer
SSHP	Site Safety and Health Plan
TCE	Trichloroethene
TERC	Total Environmental Restoration Contract
USA	Underground Service Alert
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 Introduction

This Work Plan (Work Plan) was prepared on behalf of the U.S. Department of the Army (Army) to modify and expand select aspects of the existing groundwater remedy at Operable Unit 2 (OU2). The *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California* (OU2 ROD) (Army, 1994) presents the required remedial action objectives (RAO) and the selected remedial action alternative used to execute and accomplish the groundwater remedy for the OU2 groundwater plume. All work proposed in this document complies with, and proposes no changes to the existing OU2 ROD. Shaw Environmental, Inc. (Shaw) prepared this Work Plan under the Total Environmental Restoration Contract II (TERC) No. DACW05-96-D-0011.

Recent aquifer modeling suggests that an additional area in the Upper 180-foot aquifer, located further east of existing extraction wells (EWs) completed in the Upper 180-foot aquifer, is not currently being captured. Implementing this Work Plan is necessary to continue to satisfy the RAOs stated in the groundwater remedy portion of the OU2 ROD.

1.1 Work Plan Objectives

This Work Plan presents the technical approach and construction aspects to implement the proposed OU2 Groundwater Remedy System Expansion, Phase II. The objectives are to

- Describe the proposed expedited work.
- Detail preparatory work performed under field work variances (FWVs).
- Present the sequence and schedule of the work to be performed.
- Describe the procedures and controls during construction.
- Identify the construction documentation.
- Detail the initial shakedown and initial startup procedures.

1.2 Site Location and Description

The former Fort Ord is located in northwestern Monterey County, approximately 80 miles south of San Francisco, California (Figure 1-1). The former military installation covered about 28,000 acres, is bounded by Monterey Bay to the west and the Santa Lucia Range to the south, and is surrounded by the cities of Del Rey Oaks, Marina, Sand City, and Seaside. State Highway 1 and the Southern Pacific Railroad traverse through the western portion of the former Base, separating the Monterey Bay beach front from the rest of the installation. The installation served as a training and staging facility for infantry troops from its opening in 1917 until it closed in 1993. In 1990, the former Fort Ord was placed on the U.S. Environmental Protection Agency National

Priority List, primarily due to volatile organic compounds (VOCs) found in the groundwater beneath the OU2 Landfills.

Operable Unit 2 formerly included six landfill cells; one cell north and five cells south of Imjin Road (Figure 1-2), covering approximately 150 acres, including the immediate surrounding area and underlying impacted groundwater. As part of the OU2 Landfills remedial activity, the contents of the north landfill cell were moved to the southern landfill cells. The southern landfill cells have been consolidated with fill from the north OU2 Landfills and other Fort Ord soil remediation sites, capped, covered with fill, and revegetated.

The two groundwater aquifers of interest within OU2 are the unconfined A-aquifer and the confined Upper 180-foot aquifer. Both aquifers consist predominantly of fine- to coarse-grained sands. The two aquifers are separated by the Fort Ord-Salinas Valley aquiclude, which consists of blue-gray plastic clay with abundant shells and occasional thin beds of fine-grained sand. Depth to groundwater in the A-aquifer is approximately 100 to 180 feet below ground surface (bgs). Groundwater in this aquifer flows generally to the north and deviates to the west and east from a north-trending groundwater divide extending from the eastern portion of the OU2 Landfills to Fritzsche Army Airfield. Depth to groundwater in the Upper 180-foot aquifer is between 110 and 220 feet bgs. Groundwater in the Upper 180-foot aquifer generally flows east toward the Salinas Valley (HLA, 1999).

1.3 Operable Unit 2 Constituents of Potential Concern

The OU2 groundwater plume, in the Upper 180-foot aquifer and A-aquifer, is defined by the occurrence of chlorinated VOCs present at concentrations that exceed aquifer cleanup levels established in the OU2 ROD (Army, 1994). The 11 constituents of potential concern include benzene, carbon tetrachloride, chloroform, 1,1-dicholoroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,2-dichloropropane, methylene chloride, tetrachloroethene, and vinyl chloride. Trichloroethene (TCE) is the most common and widespread of the VOCs and is used in this Work Plan to illustrate plume extent.

1.4 Existing Operable Unit 2 Groundwater Remedy

The original OU2 groundwater remedy was installed in 1995, and was modified in 2001. It currently consists of sixteen A-aquifer and six Upper 180-foot aquifer EWs, the Groundwater Treatment Plant (GWTP), three injection wells, two infiltration galleries, and a discharge pipeline to the Sites 2 and 12 GWTP.

The OU2 GWTP contains four 20,000-pound liquid phase granular activated carbon (LPGAC) adsorption vessels, two backwash tanks, a 10,000-gallon effluent tank, and ancillary pumps and piping. The treatment capacity of the GWTP with the two pairs of two LPGAC beds operating in parallel exceeds 1200 gallons per minute (gpm), but throughput flows have been reduced due to injection and extraction flow restrictions.

Treated water from the effluent tank is pumped to the recharge points via one or more of the four single-contained pipelines. The eastern recharge line conveys treated water to one eastern injection well. Two western recharge lines convey water to either the northwestern or southwestern injection wells and infiltration galleries. The fourth line conveys excess treated water to the Sites 2 and 12 discharge point.

1.5 Operable Unit 2 Groundwater Remedy System Expansion Rationale

The effectiveness of the existing groundwater remedy has been previously presented in various reports. The year 2001 modification added three A-aquifer and four Upper 180-foot aquifer EWs; extended the existing extraction pipeline system to these wells; doubled the water flow capacity of the GWTP; and increased the injection flowrate capacity.

Subsequent groundwater monitoring data indicated that the Upper 180-foot aquifer plume is not yet completely captured by the modified extraction system. The *Draft Report of Quarterly Monitoring, October through December 2004, Groundwater Monitoring Program, Fort Ord, California* (Mactec, 2005), states the following:

> TCE concentrations in wells located on the downgradient edge of the OU2 Upper-180 Aquifer plume indicate migration of the plume beyond the effective capture area of the OU2 groundwater treatment remedy and extraction wells EW-OU2-05-180 and EW-OU2-06-180, as described in the *Draft Final Annual Evaluation Report, OU2 Groundwater Remedy, Former Fort Ord, January through December 2002* (Ahtna, 2003)…
>
> In response to the apparent migration of the plume, one Lower 180-foot Aquifer monitoring well (MW-OU2-78-180) and one Upper 180-foot Aquifer extraction well (EW-OU2-07-180) were installed in November and December, 2004, approximately 30 feet east of MW-OU2-61-180. EW-OU2-07-180 is designed to capture the plume in the Upper 180-Foot Aquifer just downgradient of MW-OU2-61-180 before it enters the Lower 180-foot Aquifer…

Installation details and subsequent activities are continued in Section 3.1 below.

2.0 Pre-Construction Activities

This section describes field activities to be conducted during the construction and installation phase. Work will be sequenced to minimize the operational downtime impact to the existing GWTP.

The major field and construction activities include:

- Biological clearance
- Temporary construction activities
- Material handling
- Utility clearance
- Clearing and grubbing.

2.1 Biological Clearance

All work completed as part of this proposed OU2 groundwater remedy system expansion will be performed in accordance with the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (HMP) (Army, 1997). Environmental impacts associated with remediation activities include potential disturbance of habitat to facilitate construction of the remedy system.

Figure 2-1 presents an aerial photograph with the location of the existing and proposed EWs and pipeline route in relation to habitats and special-status species. The EWs and pipeline route is located outside of the habitats and special-status species. Though drilling and trenching activities will not impact habitats and special-status species, the following general mitigation measures will be implemented:

- Awareness of the known locations of sensitive resources in the area and avoidance of those resources during construction

- Establishing fenced or flagged exclusion zones, when appropriate and necessary, to prevent accidental intrusion into areas that may support sensitive resources.

2.2 Temporary Construction Activities

The following sections present the activities to be completed and the requirements for successful construction:

- Notification
- Traffic Control
- Site Security

- Dust Control
- Erosion Control.

2.2.1 Notification

Public notifications and notifications of road closures and traffic controls will be made at least one week in advance to the following agencies:

- Fort Ord Base Realignment and Closure Office
- Presidio of Monterey Federal Police
- Ord Military Community Fire Department
- Marina Coast Water District.

In addition to the above notifications, signs will be placed at the affected locations at least one week in advance of the work. The signs will be placed in locations that are clearly visible and not distracting to traffic. The Army will issue a fact sheet describing the construction activities and the schedule of completion.

2.2.2 Traffic Control

Prior to beginning work, work zones will be established to isolate construction activities. Where practical, clearly marked barricades will be erected to route vehicle and pedestrian traffic around the construction areas. The work zones will protect the public from the potential hazards of heavy equipment and open excavations. Flaggers will be present during trenching and pipeline installation along public roads. To minimize impact on traffic, construction along public roads will be conducted during the weekend.

2.2.3 Site Security

Appropriate security procedures will be implemented for controlling access by the public, personnel, and vehicles into potentially dangerous or hazardous working areas. Access will be controlled by security fencing, lighting, and warning signs. Only project personnel, subcontractor personnel, and authorized visitors with proper identification will be allowed access to the work sites.

The site security for the remediation sites will consist of the following measures:

- Fencing (chain link or safety) will be installed to prevent public access to the sites, particularly to those involving deep excavations.

- Materials and supplies will be placed at the OU2 Landfills equipment yard.

- Plastic barrier fence, steel posts, or fencing will be installed to segregate areas of work activity.

- Signs stating "Authorized Personnel Only" will be installed around areas of work activity.
- Warning signs will be erected at specific areas to provide warning of hazardous conditions in accordance with the requirements of the *Basewide Site Safety and Health Plan, Former Fort Ord, California* (SSHP) (Shaw, 2004).
- Notify local law enforcement in the event of vandalism, trespassing, and breaking and entering. It is not intended that project personnel assume a confrontational role.

2.2.4 Dust Control

During remediation activities, particular emphasis will be placed on minimizing the generation of fugitive emissions. Water will be used as a general dust suppressant. In addition, the following operational and administrative controls will be used in controlling fugitive dust during excavation and backfilling activities. However, conditions may dictate the necessity of operational and administrative controls.

Operational controls include the following:

- Minimizing material free-fall from excavating equipment (loaders and excavators) to hauling units and stockpiles
- Covering or water spraying loads when transporting materials
- Covering or water spraying stockpiles
- Water spraying haul roads.

Administrative controls include the following:

- Maintaining speed limits
- Restricting operating hours during construction
- Shutting down work activities when warranted, based on site conditions.

2.2.5 Erosion Control

Best management practices will be used for erosion control on construction sites. Erosion control measures will be selected for specific site conditions and may include soil stabilization, silt fences, hay bales, and sand bags.

2.3 Material Handling

Waste materials consist of vegetation, soil, asphalt, and concrete may be generated during construction:

- Vegetation from clearing and grubbing will be taken to the OU2 Landfills where it will be allowed to decompose.
- Trenches will be completed within areas free of soil contamination. The soil will be considered clean unless there is visible evidence otherwise. Soil will be reused to backfill the trenches. Any excess soil may be taken to the OU2 Landfills and stockpiled for future use.
- Concrete and asphalt from trenching along roads will be taken to a recycling facility.
- Drilling wastes will be kept separate by type (i.e. drill cuttings will not be mixed with wastewater). Drill cuttings, drilling mud, and waste water will be sampled to determine proper disposal.

2.4 Utility Clearance

Prior to trenching, excavation, or drilling, a utility clearance will be conducted to minimize contact with buried utilities. Shaw will mark the area requiring utility clearance and request clearance from Underground Service Alert (USA) utility locating service. USA will contact all local utility companies to locate and mark utility line locations. A geophysical clearance survey will also be conducted. Existing Fort Ord utility maps will also be utilized to identify and locate other utilities that may be present.

2.4.1 Geophysical Survey

The geophysical survey will be conducted along Abrams Road and the Shoppette detect and locate subsurface utilities to an approximate depth of 4 feet, with a location accuracy of approximately 6 inches. The geophysical survey complies with the requirements of Health and Safety (HS) 308 for avoiding contact with underground utilities. This work will conform to the standards and procedures set forth by the U.S. Army Corps of Engineers (USACE), State of California, and Shaw Standard Operating Procedure T-GS-016 and T-GS-042. A suite of geophysical and navigational instruments will be deployed to locate and detect any possible utilities and subsurface conflicts.

The targets of this survey are any buried utilities found to a depth no greater than 4 feet. The anticipated utilities will consist of a variety of types, sizes and materials, including (but not limited to):

- Terra-cotta,
- Polyvinyl chloride,

- High Density Polyethylene (HDPE),
- Metal,
- 12 kilovolt aluminum direct wires, and
- Reinforced concrete pipe.

Considering the variety in composition of the possible utilities, several instruments will be deployed. These include:

- Geonics EM61-MKII time-domain electromagnetic metal detector
- GSSI SIR-3000 ground penetrating radar system (GPR)
- Metrotech Conventional Utility locator (CUL)
- Trimble Real-Time Kinematic (RTK) global positioning system (GPS).

Data will be processed and interpreted on-site. Preliminary interpreted utility locations will be marked, either by spray paint or flags, prior to site demobilization. A summary report and supporting maps and data will be provided no later than two (2) weeks after demobilization.

1. <u>Survey Grid</u>: A survey grid marked every 10 feet will be created within the pre-established survey area prior to the commencement of data collection. This grid will be used to assist in the acquisition of the geophysical data. The coordinates of the grid corners, startpoints, midpoints (every 50 feet), and endpoints of the survey lines will be acquired using the GPS.

2. <u>Electromagnetic Survey</u>: An integrated geophysical/navigational survey using the Geonics EM61-MKII and Trimble RTK GPS systems will be acquired across the entire site. The survey data will be obtained along survey lines spaced no greater than 2.5 feet apart where possible.

3. <u>Metrotech Sweep</u>: A Metrotech CUL will be employed in a passive mode sweeping the entire survey corridor to detect the presence of electrical current-carrying lines or piping. Further, any exposed utilities (metallic in composition) that daylight within or adjacent to the survey corridor will be tracked by using the Metrotech in the “active” mode. This involves inductive or direct connection to the exposed utility and tracking it into the subsurface.

4. <u>Ground Penetrating Radar System Test</u>: Ground penetrating radar test survey data will be gathered across a known buried utility to help determine the antenna frequency and system parameters to optimize data resolution and quality to detect the target utilities.

5. <u>Ground Penetrating Radar Transect Data</u>: GPR data will be acquired continuously along transects lines every 10 feet. Fiducials will be marked every 5 feet during data collection to assist in overall data positioning. Four (4) – 1200 foot GPR data sets will be acquired parallel to Abrams Road, and an additional 121 – 30 foot transects will be acquired perpendicular to these lines. Possible modifications to the regular survey grid may be applied in the field as dictated by site accessibility or as required by

preliminary review and interpretation of the geophysical data. The start and end points of each transect will be located using the RTK GPS.

6. Data Processing: All the geophysical data acquired will be processed and analyzed on-site to determine the location of any utilities, seen in the electromagnetic and/or GPR data. Preliminary maps and GPS waypoint files will be generated to assist in subsequent field marking of these utilities.

7. Utility Marking: Any utilities encountered during any of the surveys outlined above will be marked with spray paint and/or pin flags. Waypoint files may also be uploaded to the RTK GPS and to assist in navigating to any known utilities.

8. Report and Maps: Two (2) weeks following field demobilization, a final letter report along with geophysical data maps and figures will be generated in-house. This report will summarize and document the findings during this utility survey and clearance.

State regulatory requirements will be referenced to if they are found to impact the overall geophysical project effort.

2.4.2 Drilling

Prior to drilling, the subcontractor will dig a pilot hole no less than 1 foot in diameter to a minimum depth of four feet below ground surface, and a maximum depth of five feet to check for underground utilities.

2.4.3 Potholing

Potholing will be conducted in areas where underground utilities have been identified by USA, as-built drawings, or geophysical surveys. A combination of backhoe and hand digging will be used to expose known underground utilities. In accordance with HS 308, only hand digging will be conducted within three feet of underground high voltage, product or gas lines. Once the lines are exposed, heavy equipment can be used but must remain at least three feet from the exposed line.

2.5 Clearing and Grubbing

Clearing and grubbing will be conducted using a combination of mechanical and manual methods. Where feasible, a mechanical device will be used. Manual tools such as brush hogs and trimmers will be used in areas where the mechanical cutter cannot gain access. An approximate 20-foot wide area along the pipeline route will be cleared and grubbed to facilitate equipment access during field activities. Drilling locations will be cleared as necessary to facilitate drill rig access.

Trimming of tree branches extending into the project area will be allowed to facilitate access. Trees will be pruned in accordance with the following requirements presented in the HMP (Army, 1997):

- Remove lateral branches as necessary at their point of origin on the trunk or parent limb.
- Final cut should be made in branch tissue close to the trunk or parent limb, without cutting into the branch bark ridge or collar, or leaving a stub.
- Cuts should not be made flush with the stem of the tree.
- Branches too large to support with one hand should be precut to avoid splitting or tearing of the bark.

Vegetation from clearing and grubbing will be taken to the OU2 Landfills where it will be allowed to decompose.

3.0 Construction Activities

This section summarizes the completed construction activities covered by previous FWVs and specifications that are related to this effort, the planned construction activities, and potential additional work activities directly related to this work effort. Related procedures detailed instructions are contained in applicable drawings (Appendix A) and specifications (Appendix B).

3.1 Extraction Well

Up to three additional Upper 180-aquifer EWs may be connected to the OU2 GWTP as part of this effort. The requirements for the EW-OU2-07-180 are presented in FWV TII-086 issued in November 2004 prior to installation. The EW screen was constructed from 210 to 260 feet bgs with a 10-inch, 50 feet long, type 304 stainless-steel wire-wrapped screen with slot size of 0.045 inches. The construction details for EW-OU2-07-180 are provided in Figure 3-1 and in Construction Drawing M-1, Appendix A.

Testing indicated that EW-OU2-07-180 is ineffective in capturing the TCE plume within the Upper 180-foot aquifer (Section 4.2). Since testing showed that this EW will have minimum impact on the capture of the plume, up to two additional EWs may be installed to maintain capture of the eastern portion of the plume. Initially, one shallow EW, located in the vicinity of EW-OU2-07-180, will be installed and operated. The decision to install the second EW will be based on the performance of the initial shallow EW. Installation of the second shallow extraction well and/or operation of existing extraction well EW-OU2-07-180 will occur only if operation of these wells will enhance plume capture.

The screen interval for the shallow EWs will extend from approximately 180 to 220 feet bgs and comprised of 10-inch diameter, 40 feet long, type 304 stainless-steel wire-wrapped screen with slot size of 0.045 inches. EW details are shown in Construction Drawing M-1, Appendix A.

3.1.1 Extraction Well Vault

Each EW will be constructed with a vault to allow for well head access and extraction pipe and electrical connections below grade. The requirements for the EW vault and lid are presented in FWV TII-086 issued in November 2004 prior to drilling. The installation of EW-OU2-07-180 and its concrete vault has been completed. Similar construction design and techniques will be used for the shallow Upper 180-foot aquifer extraction wells and vaults. A description of the concrete vault and lid follows.

3.1.1.1 Concrete Vault

The underground 9-foot by 6-foot by 4-foot deep by 8-inch thick concrete vault was constructed on site. The concrete vault contains access blockouts for the wellhead, extraction piping, and electrical conduits. The vault was placed on a 95 percent compacted, 8-inch thick layer of class II aggregate base over a layer of geotextile fabric. The radial area around the wellhead was excavated to install a 36-inch diameter concrete sump. The concrete sump is 18 inches deep and grouted to the vault's bottom. Concrete was composed of Portland cement conforming to American Society for Testing and Materials (ASTM) C150, type I or II; coarse and fine aggregate conforming to ASTM C33; and clean, potable water free of deleterious amounts of oils, acids, alkalis, salts, and organic material. A construction joint was installed in the vault between the walls and floor to resist hydrostatic pressure. The top of the vault is completed to just above the existing grade level, and can be accessed through a traffic-rated, lockable lid.

3.1.1.2 Vault Lid

The vault lid is constructed of corrosion-resistant aluminum, and is attached to the concrete vault by stainless steel type 303 mounting bolts and nuts. Lid frames, mounting hardware, washers and other fittings are composed of stainless steel type 304 or 316. Anchor bolts are stainless steel type 304 and penetrate the concrete a minimum of 4 inches on the vertical axis and at least 3 inches on the horizontal axis.

The lid is spring-loaded and hinged, with a recessed lock box. The hinged lid is capable of being locked closed, and at some point 90 degrees or greater. Two lids were installed to meet the requirement of no than 60 pounds maximum force to open. Vault lids have a rain water collection tray. When the lid is closed, falling rain does not enter the concrete vault, but is drained away from the vault.

3.1.2 Mechanical Installation

Selection of the extraction well pump and motor will be completed following installation and performance testing of each EW. Installation of the well pump and motor will be as follows:

A pump and motor will be attached to a stainless steel downhole pipe, which itself is attached to the well cap which rests on the top of the EW casing (Construction Drawing M-1, Appendix A). Power cables with a waterproof termination fitting will be installed from the submersed motor to the electrical panel in the well vault.

Mechanical fittings within the well vault include the globe valve, sample port, pressure switch and gauge, flowmeter, and gate valve. The gate valve is the last device between the wellhead completion and the underground pipeline. Because of the potential pressure induced by the well pump, the globe valve and all components between the well cap and globe valve are rated a minimum 250 pounds per square inch (psi). Components after the globe valve within the well vault are rated to 160 psi.

3.2 Trenching and Street Crossing

The extraction pipeline will convey groundwater from one or more EWs to the existing GWTP. The proposed route is shown in Figure 2-1, and generally follows street right-of-ways and around existing housing areas to minimize easement impacts. The following section details trench and street crossing construction aspects shown in Construction Drawing M-2, Appendix A.

3.2.1 Trench Excavation

After clearing and grubbing, the trench excavation will be performed using a suitable backhoe or excavator. The excavation will follow the pipe alignments and survey stakes. The side slopes will be laid back at the angle of repose of the in situ material if native soil lacks the physical characteristics to support the trench walls. Deeper excavations, if required, will be benched, laid back, or shored. The excavated soil will be placed adjacent to the trench at a minimum distance of 2 feet from the edge to minimize trench wall collapse.

3.2.2 Asphalt and Concrete Removal and Repaving

Asphalt removal and repaving, and concrete removal and repouring will be required where the groundwater pipeline or ancillary conduits cross the street at the Imjin Road and Abrams Road intersection. Asphalt removal will include saw-cutting and disposal to the local asphalt recycling plant off Imjin road. Asphalt repaving requires sub-base grading and compaction. Concrete curbs removed in these areas will also be repoured.

3.2.3 Trench Preparation for Piping

The trench will be excavated to depth. Based on previous trenching in the area, native soil at the bottom of the trench is assumed to be adequate for bedding. If it is not, clean soil will be placed in the trench bottom and on the sides of the installed pipe. Appropriately spaced grade-control stakes will be installed by the surveyor along each trench alignment. Grade stakes will be clearly marked as to horizontal offset of alignment, well locations, planned bottom of trench, planned pipe connections, and pipe invert elevations.

During construction, grades will be checked to confirm that specified locations and elevations have been achieved. Grade checking will be confirmed by the surveyor under direction of contractor quality control (CQC) personnel.

3.2.4 Trench Backfill

Trench backfilling will commence upon completion of conveyance pipeline placement and testing. Partial backfill to restrain the pipeline is allowed prior to the pressure test. Backfill sand will be placed on both sides of each pipe, the full width of the trench, and up to the spring line. Vibratory plate compactors or water jetting may be used to compact the sand and ensure that the pipe is adequately supported. Fill will then be placed in loose lifts not to exceed 24 inches. Leak detection and control cable conduits will be placed as appropriate. Filling and compaction will continue until the trench is to final grade. A colored, inscribed, metal-impregnated warning tape will then be placed at approximately 1-foot below finish grade. Trenches in traffic areas will be backfilled as soon as possible to minimize traffic disruptions. Paved areas will be resurfaced to original conditions after trenches are backfilled and compacted.

3.2.5 Revegetate Pipeline Areas

All nonasphalt pipeline and vault areas will be regraded to near original conditions. To allow for future maintenance access to the pipeline and vaults, native plants will not be replaced, unless specifically identified during the biological survey.

3.3 Extraction Conveyance Pipeline

Known building, utility, and other interferences have been reviewed and incorporated into the construction drawing and specifications. Alignments will be field verified to ensure that there is sufficient clearance for the excavation work to be completed without endangering nearby structures. The pipeline routes will be marked for belowground utilities and pipelines by USA utility locators per Section 2.0. The following section presents the conveyance pipeline and installation procedures.

3.3.1 Conveyance Pipeline Design

Double-contained, high-density polyethylene or equivalent pipe will be used to connect each EW to the existing pipeline system. The extraction pipeline will include about 2,700 feet of 6-inch by 10-inch and 950 feet of 8-inch by 12-inch double-contained conveyance pipe (Construction Drawing C-3, Appendix A). Pipe length may be adjusted based on field routing to avoid utilities or other obstructions. Pipe stubouts will be installed in select areas for contingent future EWs. The specified sizes of pipe, tees, and elbows and associated valves, vents, and drains will be installed within the trench and connected together per the manufacturer's recommendations. The pipe manufacturer's specified pipe connection cure time will be adhered to prior to testing and commencing trench backfilling operations.

Leak detection conduit and control wiring conduit will be installed within the extraction pipeline trench. The extraction pipeline will include maintenance access for leak detection, high-point air relief valves, and low-point drainage of the system.

3.3.2 High and Low Points

High point and low points will be placed inside vaults. Vaults will be precast and delivered or cast in place. Appropriate water stops will be installed at anticipated cold joints unless a continuous pour is performed. The vaults will be located in nontraffic areas with the top placed

6 inches above ground to reduce stormwater and surface drainage into the vaults. Covers will be incidental-traffic, H-10 load rating. In areas of vehicular access, the vaults and covers will be either H-20 load rated or have bollards placed around the vault. Covers will be corrosion resistant and installed with a secure locking mechanism. Construction Drawings M-2 and E-5 (Appendix A) presents high point vent detail, low point drain detail, vault, vault collar and vault lip drain.

3.3.3 Pipeline Abandonment

Approximately 640 feet of the existing pipeline along Imjin Road (Figure 2-1) will be abandoned in place. The pipeline to be abandoned will be flushed with potable water and then drained prior to being capped.

3.3.4 Isolation Valve

An isolation gate valve will be installed in the 8-inch by 12-inch pipe section just after the connection to the existing Abrams/Imjin extraction wells. This isolation valve serves to isolate the pipeline to EW-OU2-07-180. An existing pipeline isolates flow to the Abrams/Imjin pipeline line, and will be closed during construction until the new isolation valve is installed. The isolation valve will be placed inside a vault. Vault will be precast and delivered or cast in place. The vault will be located in a nontraffic area with the top placed 6 inches above ground to reduce stormwater and surface drainage into the vault. Cover will be incidental-traffic, H-10 load rating. Covers will be corrosion resistant and installed with a secure locking mechanism. Details are presented in Construction Drawing M-2, Appendix A.

3.3.5 Alignment Marking

A licensed surveyor will survey, prior to backfill, pipeline routes, tops of well casing, and tops of well vaults. As-built drawings locating the actual pipe alignments and construction relative to permanent survey monuments will be developed. Horizontal control will be surveyed to ±0.1 foot and vertical control to ±0.01 foot. Following final grading and paving, the pipeline location will be marked with a series of signs to warn others of the piping location.

3.4 Electrical Power Installation

A new electrical service drop will be requested in the vicinity of the new EWs. The installation will conform to Pacific Gas and Electric (PG&E) design standards and local installation guidelines. The PG&E side of the service drop will be composed of an underground three-phase 12.4 kilovolt tap; a transformer to reduce voltage to 480 volts; and underground service conduit to the service drop. The service drop will be composed of a lockable box, fusible meter main with disconnect, and PG&E meter, installed on a small, aboveground concrete pad.

An underground conduit will supply power to a lockable electrical panel installed within each underground EW vault. Power wiring will be continuity tested and terminated. The electrical system will be installed and grounded per National Electric Code requirements. Construction Drawing E-4, Appendix A, shows the proposed location of the power drop and the route of the trench from the power drop to EW-OU2-07-180.

Construction Drawings E-1 through E-12 (Appendix A) shows the electrical site plan, vault layout, and wiring diagrams.

3.5 Instrumentation and Leak Detection Installation

After a majority of the mechanical features have been installed, the remaining instruments will be installed, wire connections tested and then terminated. A titanium transducer with cable will be installed to just below the level of each EW pump. Signal wire from the pressure switch, flowmeter and transducer, located within the EW vault, will be terminated inside the instrumentation control panel. The amount of information from the new EWs will be consistent with the amount of information currently being sent to the existing programmable logic controller (PLCs). From the instrumentation control panel, a fiber optic cable will convey instrumentation information back to the PLC located at the southwest corner of the Abrams/Imjin intersection. Well pump control features will also be relayed back, through the fiber optic, to the instrumentation control panel, similar to the current installation. The fiber optic cable will be placed in one of two electrical conduits paralleling the HDPE water pipeline.

Leak detection sensors will be placed to monitor the annular sections of the extraction conveyance pipeline. Anticipated locations are shown on Construction Drawing C-3, Appendix A, and are sited to be at the low or at mid-low points of the pipeline. Leak detection wire for the conveyance pipe will be individually rung and terminated. Either a break in the leak detection line, or a positive leak detection, will instruct the well pump to turn off. The fiber optic and leak detection will be installed in parallel but separate polyvinyl chloride conduits.

3.6 Supervisory Control and Data Acquisition / Instrumentation Interface

Information to operate the EW pumps will be locally programmed into both the existing Abrams/Imjin PLC and within the new instrumentation panel located near EW-OU2-07-180. A separate effort will be required to integrate these signals into the existing supervisory control and data acquisition (SCADA) control system located at the OU2 GWTP control room. The anticipated effort includes adding an additional well to the existing monitoring screens, and to verify data is being received, logged and properly interpreted.

3.7 In Line Pump

As stated earlier, the existing OU2 GWTP was previously modified in year 2001, primarily by adding a parallel treatment train of LPGAC, and installing additional extraction wells. The parallel treatment train effectively doubled the potential throughput capacity of the GWTP to above 1200 gpm. The additional extraction wells installed east of the Eastern Network were plumbed into the existing 8-inch by 12-inch double-contained pipeline. Because of pipeline flow capacity limitations, water flow into the GWTP has been limited. Other flow constraints exist after the GWTP, mainly in treated water injection capacity. Construction Drawings C-1 and C-2 (Appendix A) show the GWTP process flow diagrams.

A water flow restriction study revealed that the highest pipeline pressure, and the area with the greatest pressure drop occurs in the pipeline between the GWTP and the Abrams line of extraction wells. Flow capacity along this section actually diminished when the 12th Street was realigned into Imjin Parkway. A replacement pipeline with a slightly reduced inner diameter was used, resulting in higher pressure drops through this section.

The study also revealed that a properly placed pump or pumps could be placed to increase the flow rate through this pipe section. This pump option is substantially more cost effective than replacing or adding a parallel pipeline. A "Wye" vault previously installed in year 2001 was found to be in the second best place for a new booster pump. The best place for the pump was found to be at the intake of the existing GWTP. This site minimizes installation costs since it can be installed in an existing facility, and uses existing electrical and installation infrastructure.

A nominal 1200 gpm in-line pump is proposed (Construction Drawing C-1, Appendix A). This pump will be installed in place of the inline static mixer (Construction Drawing M-3, Appendix A), just after the three in-line sand strainers from the three incoming untreated water lines, and before the liquid phase treatment units. The static mixer was used to mix the three in-coming streams, and allow the blended influent sample to occur from one location. Since operation of the pump also mixes the incoming water stream, the static mixer is no longer needed. A maintenance bypass line will be provided to allow periodic pump servicing. A parallel 100 percent redundant in-line pump is not required since continuous water treatment, albeit at a reduced flow, will be possible even if the pump is taken out of service.

Parallel with the mechanical installation of the pump, a variable speed drive will be installed to modulate the flow through the pump. The pump will operate based on in-line differential pressure. Since the existing discharge pumps also operate from variable speed drives, programming effort on the existing GWTP PLC will duplicate the capabilities of the existing PLC installation. A separate effort will be required to integrate these signals into the existing SCADA control system located at the OU2 GWTP control room. The anticipated effort includes adding an additional pump to the existing monitoring screens, and to verify data is being received, logged and properly interpreted.

As work progresses, mechanical and electrical inspections will be visually performed to reduce the time for shakedown and start-up. Conduit lines will be installed from the existing master control circuit to the variable speed controller to the motor. Power and control wiring will be installed within the conduits, rung out and then terminated.

Since the in-line pump will be installed on the single water line entering the GWTP, the treatment plant will be temporarily shut down during mechanical installation, and until the solvent glue has sufficiently dried for system pressure testing. Water flow will also be reduced during electrical and instrumentation checkouts and shakedown testing.

4.0 Shakedown/Startup Procedures

This section describes the initial shakedown and startup procedures.

4.1 Double-Contained Pipeline

The double-contained pipe will be visually checked, prior to pressure testing. Carrier pipe will be hydrostatically pressure tested, in sections, with potable water prior to backfill. The annular space of the secondary contained pipe will be pressure tested, in sections, with atmospheric air prior to backfill. Welds, fittings, and flanges will be left uncovered during the pressure testing. Test pressure and procedures will follow the high density polyethylene pipe manufacturer's instructions, as modified by design limitations of the ancillary connected components and following the recommendations of the field engineer.

4.2 Extraction Well

Each EW will undergo well development and well performance testing. Well development will consist of bailing and surging followed by pumping. The clay dispersant agent NuWell ® 220 will be used to remove mud and clay from the well environment. Each extraction well will be considered adequately developed when:

- The water produced is sand free and clean
- pH, temperature, and specific conductance have stabilized (+5 percent)
- Sand content less than 8 milligrams per liter.

Performance of each EW will be evaluated by conducting a pump step test to determine specific capacity. The step test shall be conducted for a period of 6 hours at increasing pumping rates (steps) throughout the test. This test will determine the optimal pumping rate for the EW without causing excessive drawdown.

Well development and aquifer testing results for EW-OU2-07-180 have been completed and are summarized in this section.

EW-OU2-07-180 was initially developed in January 2005 and redeveloped in September 2005 in an attempt to improve well efficiency. Well development was not completed in January 2005 due to insufficient water tank capacity. Approximately 20,000 gallons of water were pumped during the initial development in January 2005 and approximately 80,000 gallons in September 2005. Development consisted of adding New Well 220R© to the well water and swabbing and bailing the well for approximately 12 hours. The additive compound is designed to break up drilling mud within the filter pack material around the well screen. Groundwater pumped from the well was monitored for field parameters (turbidity, pH, electrical conductivity, and temperature).

Field parameters after completion of the well development in September 2005 were stable indicating proper development. Sand testing of the well during aquifer testing produced 0.02 milligrams per milliliter, which is negligible and indicative of a properly developed well.

Aquifer testing of EW-OU2-07-180 was conducted in September 2005 to determine proper well development, determine permanent pump size and placement, well specific capacity, characterize aquifer hydraulic properties, and determine the zone of influence of the EW. Two separate step drawdown tests were conducted. The first test pumped water from the entire 50-foot screen of the EW. The second test pumped water from only the upper 25-foot screen. A temporary well packer was installed in the lower 25-foot section of EW screen to minimize groundwater flow from the lower half of the well screen. Based on the aquifer test results the estimate maximum pumping rate for EW-OU2-07-180 is approximate 112 gpm.

Testing indicated that EW-OU2-07-180 is ineffective in capturing the TCE plume within the Upper 180-foot aquifer. Step drawdown testing of the extraction well had minimum impact on groundwater levels within adjacent monitoring wells. Analysis of groundwater pumped water from the extraction well during testing detected only very low concentrations of methylene chloride and toluene; TCE, the primary targeted groundwater contaminant, was not detected. A review of boring logs of monitoring wells within the immediate area of the extraction well suggest the presence of a thin clay layer which can inhibit vertical flow. These data indicate the Upper 180-foot aquifer within this area may be stratified which inhibits the vertical movement of groundwater. A technical memorandum summarizing the results of step drawdown testing of extraction well EW-OU2-07-180 is contained in Appendix C.

4.3 Mechanical and Electrical Completion Check

A mechanical and electrical completion check shall be performed to verify the correct installation of the connected equipment. Installation of all components need not be completed for this inspection to commence. For example, mechanically moving devices will be individually inspected prior to installation. This initial inspection includes a visual check of the wetted surface and/or moving part, confirming whether the moving part is free to operate as specified after installation.

During the final mechanical check, a visual inspection of the entire system against the construction drawings will be made to confirm that all equipment and pipelines are in their proper locations and are appropriately connected and that all bolts have been tightened and all supports have been secured to support the intended weight. The mechanical completion checklist for the initial shakedown/startup will be prepared after the mechanical items have been installed.

During the electrical check, electrical equipment and wiring will be visually checked against construction drawings to ensure proper installation and connections. The electrical completion checklist for the initial shakedown/startup will be prepared after the electrical items have been installed.

After the installation of the power system, an operating test will be performed to assure proper rotation and operation of all rotating equipment.

Following installation of the control system, the treatment plant operator will perform tests to assure proper operating conditions. Alarms and automatic shutdowns will be tested by forcing a failed condition. The SCADA system will integrate the signals from the instruments installed within the new EW and extraction pipeline to the Abrams/Imjin PLC.

4.4 Extraction System Pressure Test

The wellhead and the newly installed extraction pipeline will be pressure tested separately with potable water. Untreated water shall not be drawn out of the EWs and pumped to the GWTP until the pressure test is complete. Modifications to the system should initially be tested in the manual mode, and the instrumentation and control package should either be turned off or under limited operation. Once the wellhead and pipeline have passed their respective pressure checks, the wellhead piping will be connected to the pipeline, with this last connection also checked for leaks.

4.5 Hydrogeologic Testing

During the initial stages of continuous operation, EW and infiltration gallery testing shall be performed. Static water levels at the EWs and nearby monitoring wells will be recorded prior to the continuous operation. Results from the tests and analysis will be used to determine aquifer yields and recharge capabilities. Extraction flow rates shall be adjusted during startup and periodically during operation in order to maintain an appropriate in-well drawdown below the initial static water level. Periodic water-level measurements will be collected by on-site personnel.

4.6 Initial Startup Flowrates

The initial startup extraction and recharge flowrates will be determined based on groundwater modeling and aquifer testing. Subsequent groundwater-level data will be evaluated to determine individual well operational flow rate. Individual EWs will be periodically adjusted as required to meet the objectives of the extraction system.

5.0 Contractor Quality Control

The work will be conducted following the contractor CQC established in the *Program Contractor Quality Control Plan for Sacramento Total Environmental Restoration Contract* (PCQCP) (ICF Kaiser, 1998). A table showing the summary of project team quality control (QC) responsibilities is presented in Table 5-1.

5.1 Project Organization

This section provides a brief description of the roles and responsibilities of personnel who will be involved with the project. A project organization chart is presented in Figure 5-1.

5.1.1 Project Manager

The Project Manager, Peter Kelsall, is responsible for the quality and cost and schedule performance of all project activities, including those performed by subcontractors. The Project Manager is the primary interface with the Army and regulatory agencies.

5.1.2 Task Manager

The Task Manager, Jen Moser P. G., is responsible for day-to-day management of field activities including, but not limited to:

- Detailed planning and scheduling
- Managing Shaw resources and subcontractors
- Coordinating testing activities
- Data compilation and reporting
- Tracking the project cost and schedule and implementing corrective measures when necessary.

5.1.3 Project Engineer

The Project Engineer, Ron Hayashi P. E., is responsible for the engineering design and oversight of construction and testing activities. The Project Engineer reports to the Task Manager.

5.1.4 Contractor Quality Control System Manager

The Contractor Quality Control System Manager (CQCSM), Tom Ghigliotto, supports the Task Manager in day-to-day operations; however, the CQCSM will report functionally to the TERC II QC Supervisor, Eric Watabayashi. The CQCSM has sufficient authority, including stop work authority; to ensure that all project site activities comply with approved work documents. This authority applies equally to all project activities, whether performed by Shaw or its subcontractors and suppliers.

The CQCSM will be responsible for planning and executing QC oversight of project operations and shall ensure compliance with specified QC requirements in project plans, procedures, and contract documents.

5.1.5 Certified Industrial Hygienist

The TERC II Program Certified Industrial Hygienist (CIH), Dr. Rudy Von Burg, is responsible for the development, implementation, and oversight of the SSHP (Shaw, 2004). The CIH will provide oversight during excavation and sampling activities.

5.1.6 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO), Charles Luckie, is responsible for implementation of the SSHP and applicable corporate Health and Safety procedures. Specific responsibilities include developing activity hazard analyses (AHAs) and monitoring excavation activities for compliance with the SSHP. The SSHO is responsible to the Task Manager in day-to-day operations, but reports functionally to the TERC II CIH, Dr. Rudy Von Burg.

5.1.7 Project Superintendent

The Project Superintendent, Dan Nohrden, is responsible for day-to-day construction activities. The Project Superintendent reports to the Task Manager.

5.1.8 Project Subcontractors

Subcontracted work will be conducted in accordance with the requirements of the contract, subcontractor scopes of work.

5.2 Testing

Many of the construction activities will require testing to assure the quality of work and to verify that specifications are followed. Activities and corresponding test method and frequency that require QC testing are presented in Table 5-2. To ensure that materials and equipment used during construction meet the specified standards, manufacturer/supplier certificates will be submitted to the CQCSM when required.

5.3 Quality Control

Quality control encompasses the actions that control the attributes of a material, sample, process, component, system, or facility in accordance with predetermined quality requirements. It involves the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process. These actions are necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements. Shaw personnel will perform quality control functions.

5.4 Three-phase Inspection System

The QC inspection system is based on three phases of control to cover both on-site and off-site work. All definable features of work are covered through the three-phase system. The three-phase inspection system is detailed in the PCQCP (ICF Kaiser, 1998). The three phases include the preparatory phase, initial phase, and follow-up phase. During the preparatory phase, all work necessary to initiate the activity will be checked before the actual construction begins. Initial-phase inspections will be performed once activities begin to insure work is being performed in accordance with procedures outlined in relevant plans and as agreed in the preparatory inspection. Follow-up phase inspections will be performed daily to ensure work is being performed according to plans. Tests will be conducted as outlined in Table 5-2.

5.4.1 Preparatory Phase

The preparatory phase of the construction activity will be conducted in a meeting format. Participants will include the CQCSM, QC inspector, project engineer, field superintendent, SSHO, Army, and relevant subcontractors. During the meeting, information regarding the schedule, procurement, and the status of the related construction activity will be shared and discussed.

5.4.2 Initial Phase

Once the schedule of the activity is made, it will be up to the QC inspector to ensure the quality of the construction work performed. During the initial phase, a representative sample of work will be observed to verify the work is in compliance with the specified requirements. This includes an inspection of the correct material of construction and the acceptance of workmanship by the field construction crew.

5.4.3 Follow-up Phase

Finally, follow-up inspections will be performed on a daily basis after the initial phase until the completion of the activity. Appropriate tests will be performed to assure the quality of the construction work. Test results performed by QC will be included in the Construction Completion Report (CCR).

5.5 Quality Assurance

Quality assurance (QA) includes the planned and systematic actions necessary to provide a sufficient confidence level that a structure, system, or component will perform satisfactorily in service. When the product is a report of a significant study or investigation, QA also comprises those planned and systemic actions necessary to provide adequate confidence in the validity and integrity of the reported data, methods, and procedures and in the protection, retrievability, and replicability of the data. QA includes a multidisciplinary system of management controls backed by quality verification and overview activities that demonstrate completeness and appropriateness of achieved quality.

The USACE will provide QA oversight during the planning, design, and construction phases of the project. The Army team will be complemented with specialists in mechanical, electrical, environmental, and civil engineering, health and safety, and chemistry.

Specific QA activities include

- Formal review of the governing plans and specifications:
  - Work Plan
  - Performance Specifications and Drawings
- Review of Engineering Submittals provided by Shaw
- Review and approval of Shaw QC staffing and qualifications
- Participation in preparatory, initial and follow-up inspections
- Participation in regular technical reviews
- Periodic observation of construction progress and acceptance testing.

5.6 Deliverables

The following identifies deliverable documents and provides a brief description.

- **Draft Final Expedited Pipeline Construction Work Plan -** This document, details the methodology proposed for the construction of the pipeline and all associated components necessary for conveyance of water to the treatment plant.

- **Vendor Submittals -** Specifications and drawings will be compiled and submitted.

- **Construction Completion Report -** The CCR will include the draft final construction drawings and will document revisions made to the design presented in the Work Plan.

5.7 Subcontracts

Some or all of the work activities listed below may be subcontracted. The following is a brief synopsis of the scopes of work:

- **Geophysical Services –** detect and locate underground utilities.

- **Conveyance Piping –** supply materials.

- **Asphalt/Concrete Cutting/Repaving -** remove pavement, and repair pavement.

- **Well Vaults/Lids and Valve Boxes –** supply concrete vaults and lids for vaults and various valve boxes

- **Well Installation** – provide equipment, well construction materials, and personnel to install, develop, and test extraction wells.
- **Extraction Well Pump –** supply and install pump for EW, including electrical equipment, wiring, instrumentation, connecting piping, and pump startup.
- **In-line Pump –** supply pump for installation at the GWTP.
- **Surveying –** provide topographic, construction, and as-built information.
- **Electrical Installation –** supply and install electrical and instrumentation (wires only) materials for connection of power to various locations, such as the well head and the GWTP.
- **Instrumentation –** supply parts and labor for instrumentation, calibration, system connection, and shakedown/startup.

6.0 Safety and Health

All work activities will be performed utilizing safe work practices as detailed in the SSHP (Shaw, 2004). Field activities will be conducted in accordance with the detailed procedures and AHAs presented in the SSHP (Shaw, 2004). AHAs for specific phases of pipeline construction are presented in Appendix D. All field personnel will review and become familiar with the SSHP and the associated AHAs.

7.0 References

Athna Government (Athna), 2003. *Draft Final Annual Evaluation Report, OU2 Groundwater Remedy, Former Fort Ord, January through December 2002*

Harding Lawson Associates (HLA), 1999, *Draft Final Revised Treatment System Plan OU2 Groundwater Remedy, Fort Ord, California*, Novato, CA.

ICF Kaiser, 1998, *Program Contractor Quality Control Plan for Sacramento Total Environmental Restoration Contract*

Mactec Engineering and Consulting, Inc. (Mactec), 2005, *Draft Report of Quarterly Monitoring, October through December 2004, Groundwater Monitoring Program, Fort Ord, California*

Shaw Environmental, Inc. (Shaw), 2004, *Basewide Site Safety and Health Plan, Former Fort Ord, California*

U.S. Department of the Army (Army), 1994, *Record of Decision, Operable Unit 2, Fort Ord Landfills, Fort Ord, California*, Fort Ord, CA.

Army, 1997, *Installation-Wide Multispecies Habitat Management Plan (HMP) for Former Fort Ord, California,* (HMP)